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I, JANENE PEISKER, TEAM LEADER EXAMINATION SUPPORT AND
SALES hereby certify that annexed is a true copy of the Provisional specification
in connection with Application No. 2002952761 for a patent by VERTECH
HUME PTY LTD as filed on 18 November 2002.



WITNESS my hand this
Twenty-sixth day of November 2003

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AUSTRALIA
Patents Act 1990

PROVISIONAL SPECIFICATION

200295 filed 18th November 2002

Invention Title : Moulding of Concrete Articles

Applicant: Vertech Hume Pty Ltd [A C N 096 468 405]

Inventors: Graeme Reginald Hume

The invention is described in the following statement:

MOULDING OF CONCRETE ARTICLES

This invention relates to improvements in the moulding of concrete articles such as poles, piles or pipes in a vertical mould and particularly to the layout of a
5 production plant and the means of transporting moulded articles during moulding and curing.

Background to the invention

10 In producing precast concrete products the size and weight of the products means that the plant must be sized to accommodate cranes and transport to move the products from the mould to a curing station and then to a storage area for transport. For long concrete products such as poles, piles or pipes the land area taken up for moulding curing and storing is quite large and taking into
15 consideration the capital cost of land this can affect the economic viability of a plant.

After moulding most precast concrete articles need to be moved.

USA patent 5242249 discloses a means for lifting a precast panel which incorporates a precast insert that is hooked to the reinforcing in the panel.

20 USA patent 4992005 discloses an alternative fixed attachment for retaining wall panels which is precast into the panel.

The moulding of concrete pipes, hollow poles or piles in a vertical mould has been proposed in USA patents 4996013 and 6284172. The mould is filled from the bottom and the concrete is compressed between an inner and outer mould by moving the inner mould outwardly using a flexible membrane. The moulded pole is
25 supported by the reinforcing cage when it is moved from the mould to the curing station. When the weight of the freshly cast pole is transferred from the mould to the reinforcing cage as a preliminary step to removing the moulded product, cracking can occur. Relative movement can occur because of a change in the alignment between the reinforcing cage and the concrete in the mould. When the
30 product is lifted from the mould by the reinforcing cage slight differences in the position of the support points can cause a change in the shape of the cage and this in turn can cause cracking of the freshly moulded concrete. These patents had not addressed the need to design a plant for continuous production of poles

It is one object of this invention to provide an economic plant for the continuous production of long concrete articles such as poles, pipes and piles.

It is an object of this invention to provide a means of avoiding cracking during lifting and transfer of the moulded article from the mould.

5

Brief Description of the invention

To this end the present invention provides a plant for moulding and curing elongated concrete products which includes

- a) at least one vertical mould
- 10 b) support means above the mould to suspend the reinforcing material in the mould
- c) pump means to fill the mould with concrete so that the elongated product forms around the reinforcing material
- d) a vertical curing carousel adapted to vertically suspend the moulded
- 15 elongated product
- e) a lifting apparatus adapted to lift reinforcing material into the vertical mould, to remove the formed product from the mould, to place it on the curing carousel and to remove it from the carousel when the product is sufficiently cured for storage.

20 By using a vertical mould the footprint of the production plant is reduced with a resultant saving in land area. The other consequence of using a vertical mould and moving the vertically suspended product to an adjacent carousel for curing is that the number of operators needed can be kept to a minimum because they are able to easily inspect the suspended poles from a centrally located work platform.

25 Preferably a minimal plant layout utilizes a single central support mast which supports a work platform and two vertical moulds. Associated with each mould is a curing carousel. The number of stations on each carousel is equivalent to the time required to sufficiently cure the concrete divided by the time required to insert the reinforcing in the mould, fill the mould with concrete and dewater the concrete so

30 that the product is able to be removed from the mould. In one embodiment of the invention each carousel has 18 stations and 9 hours is needed to cure the concrete and the moulds can be filled and the product removed in half an hour.

In another aspect the present invention provides a method of forming elongated concrete products in which

- a) the products are formed in a vertical mould
- b) the products incorporate a reinforcing mesh a portion of which extends from the top of the mould
- c) the reinforcing mesh is suspended in the mould from at least two attachment points
- d) a flexible link is used to attach the reinforcing mesh to the attachment points to reduce the likelihood of relevant movement between the reinforcing and the moulded concrete during removal and transfer from the mould.

In one embodiment of the invention the product is a hollow pole or pile of square, circular or elliptical cross section which may be of constant or reducing cross section. The reinforcing mesh is of similar shape and fits within an annular mould space. A portion of the reinforcing cage extends above the mould so that it can be attached to the support means. It is preferred to use a support ring that is supported on brackets above the mould and transferable to brackets on the curing station. The support ring has at least two flexible chains which hang from two equidistant points on the ring. These flexible links allow relative movement between the ring and the cage but do not effect alignment between the cage and the concrete.

The support ring stays with the reinforcing cage from the time the reinforcing is first suspended in the mould until the elongated concrete product is cured after which the support ring is detached from the extension of the reinforcing frame and reused.

Detailed description of the invention

A preferred embodiment of the invention useful in the manufacture of hollow poles, piles or pipes is illustrated in the drawings in which:

Figure 1 is a side elevation of a first embodiment of a plant according to this invention;

Figure 2 is a series of plan views taken at five elevations in figure 1;

Figure 3 is a side elevation of the central mast of the plant as shown in figure 1;

Figure 4 is a plan view of the mast and carousels of the plant of figure 1;

Figure 5 is a plan view of another plant layout in accordance with this invention;

Figure 6 is a side elevation of the carrying system used in transporting the reinforcing cages and moulded products;

5 Figure 7 is a plan view of the carry ring of figure 6;

Figure 8 is a view of a support bracket for the support ring of figure 7.

The plant as shown in figures 1 to 4 has a central mast 11 supporting two moulds one to make 12 metre poles and the other to make 9 metre poles.

10 The central mast 11 has a spiral staircase 12 leading to the work platform 13 for the 12 metre poles and to platform 14 for the 9 metre poles.

The moulds are inverted relative to the poles and the formers 19 and 20 for forming the poles are located at the base of mast 11 and extend up to the appropriate work platform 13 and 14. The mould cores are held at the top of the mast and are lowered via the guide rails 15 and 16 into the formers to define a
15 vertical long annular mould space. The detail of the mould construction is the same as that described in USA patent 6284172 the contents of which are herein incorporated by reference. The mould may be hinged on one side with a series of wedge clasps on the other at centres of 300 to 750mm apart mounted on a vertical steel column. The column is operated by two hydraulic cylinders. An alternate
20 embodiment has the wedge fastening on both sides so that the mould shells remain parallel when being removed from the freshly moulded concrete articles.

The sequence of steps in closing the mould may be

1. close mould around reinforcing cage and lock
2. lower core down through centre of cage
- 25 3. raise the column and lock
4. close the mould caps

steps 1 and 2 can be reversed and steps 3 and 4 may be simultaneous. To avoid damage to the core the cage needs to be centred with the core during installation.

The reinforcing cages for the poles are raised upside down into position by the
30 raising trusses 23 and 24 and then lifted into the mould space using the articulated lifting beams 27 and 28. The reinforcing cage 67 is attached to a support ring 61 as shown in figures 6 and 7 by the flexible links 65 that hang from the link mounts 64. The ring 61 is supported on the bracket mounts 63 by the brackets 69 shown in

figure 8. These brackets are located on the central mast 11 about 300mm above the top of the mould. The link mounts and the bracket mounts are at right angles to each other and the flexible links 65 include at least one pivot point so that there is little likelihood of relative movement between the reinforcing 67 and the concrete of the pole 66.

After the mould has been filled with concrete and the concrete dewatered in accordance with the procedure described in USA patent 6284172 the mould is opened in the following sequence

1. remove the top mould cap
2. split the concrete at the bottom
3. lower the column
4. raise the core
5. open the mould.

Associated with each mould are curing carousels 31 for the 12 metre pole and 41 for the 9 metre poles. These carousels are fabricated from steel sections and are insulated. The insulation is preferably foamed polystyrene/steel sandwich panels. The carousels are rotated manually or hydraulically using a ratchet system. the bearings for the carousels may be a large antifriction bearing a large sliding bearing or a central spherical bearing.

The formed poles, supported by the support ring 61 are transferred to the support hooks 33 or 43 by the lifting beams 27 and 28 and are moved around the periphery 32 or 42 of the carousels 31 and 41.

In an alternate embodiment the lifting beams for the reinforcing cage may be separate from those used for lifting the moulded poles.

The number of positions on each carousel corresponds to the curing time divided by the moulding time for each pole.

A different plant layout is shown in figure 5. Again a single mast 11 supports a work platform 53. The spiral access staircase 12 is adjacent the mast. Two moulds are used and the mould halves 51 and 52 are shown. The reinforcing cages are moved into the work area using an overhead travelling crane 56 which also removes the formed poles 55 when they are cured. The curing carousels 57 and 58 are similar to the carousels of figures 1 to 4 and using the same carrying ring as described for figures 6 to 8. A pair of articulated lifting beams 54 transfer the

reinforcing to the moulds, the moulded poles to the carousels and then the cured poles 55 back to the traveling crane 56 for removal to the storage and transport section of the plant.

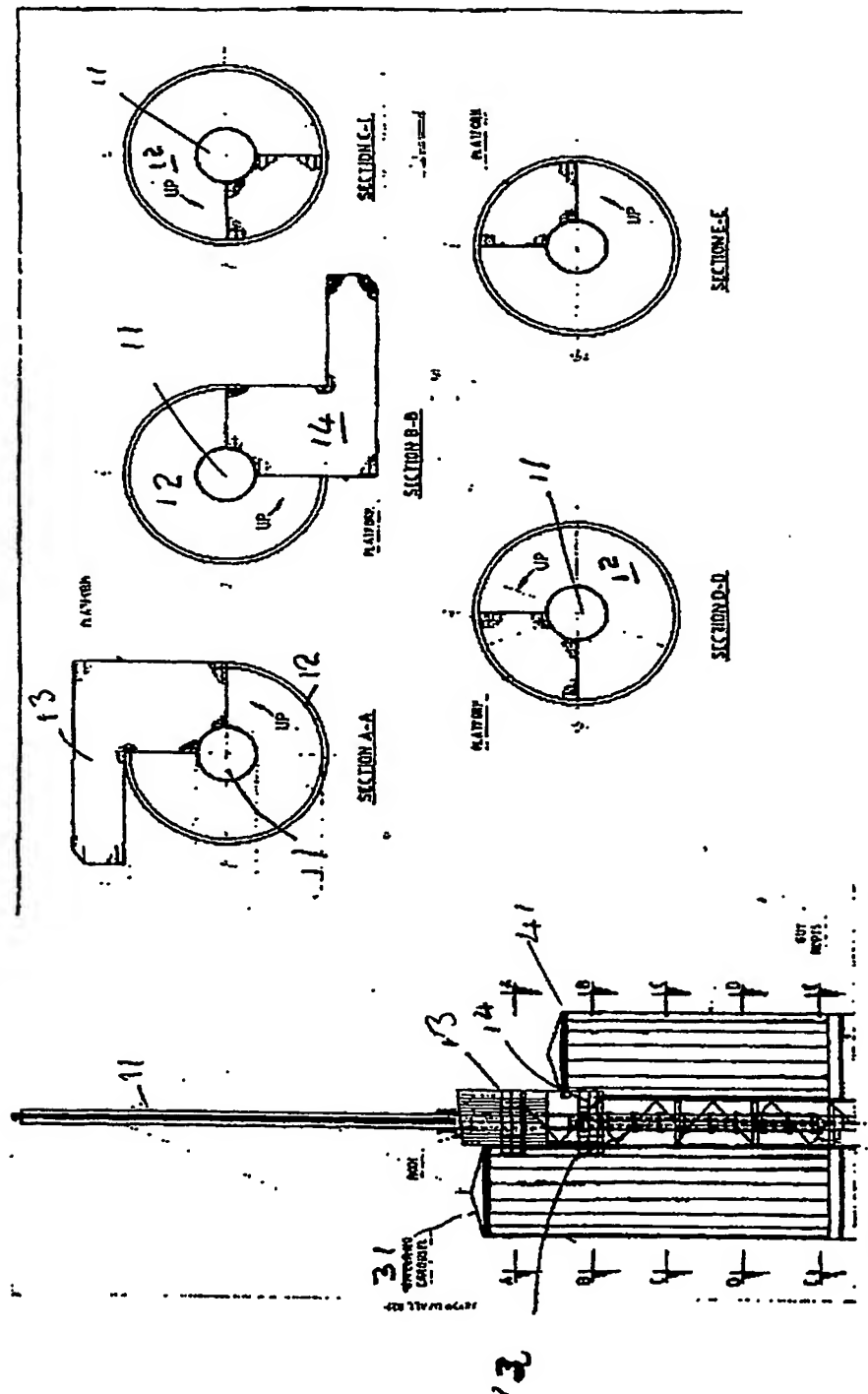
- 5 Those skilled in the art will realize that the invention may take many forms, apart from the embodiments described above.

CLAIMS

1. A plant for moulding and curing elongated concrete products which includes
- a) at least one vertical mould
 - 5 b) support means above the mould to suspend the reinforcing material in the mould
 - c) pump means to fill the mould with concrete so that the elongated product forms around the reinforcing material
 - d) a vertical curing carousel adapted to vertically suspend the moulded
10 elongated product
 - e) a lifting apparatus adapted to lift reinforcing material into the vertical mould, to remove the formed product from the mould, to place it on the curing carousel and to remove it from the carousel when the product is sufficiently cured for storage.
- 15
2. A method of forming elongated concrete products in which
- a) the products are formed in a vertical mould
 - b) the products incorporate a reinforcing mesh a portion of which extends from the top of the mould
 - 20 c) the reinforcing mesh is suspended in the mould from at least two attachment points
 - d) a flexible link is used to attach the reinforcing mesh to the attachment points to reduce the likelihood of relevant movement between the reinforcing and the moulded concrete during removal and transfer from the mould.
- 25

ABSTRACT

e) . A plant for moulding and curing elongated concrete products such as poles piles and pipes which includes at least one vertical mould, support means above the mould to suspend the reinforcing material in the mould, pump means to fill the mould with concrete so that the elongated product forms around the reinforcing material. A vertical curing carousel adapted to vertically suspend the moulded elongated product is associated with each mould. A lifting apparatus is used to lift reinforcing material into the vertical mould, to remove the formed product from the mould, to place it on the curing carousel and to remove it from the carousel when the product is sufficiently cured for storage. The products incorporate a reinforcing mesh which is suspended in the mould from at least two attachment points so that a portion extends from the top of the mould. A flexible link is used to attach the reinforcing mesh to the attachment points to reduce the likelihood of relevant movement between the reinforcing and the moulded concrete during removal and transfer from the mould.



F. 92

Fig 1

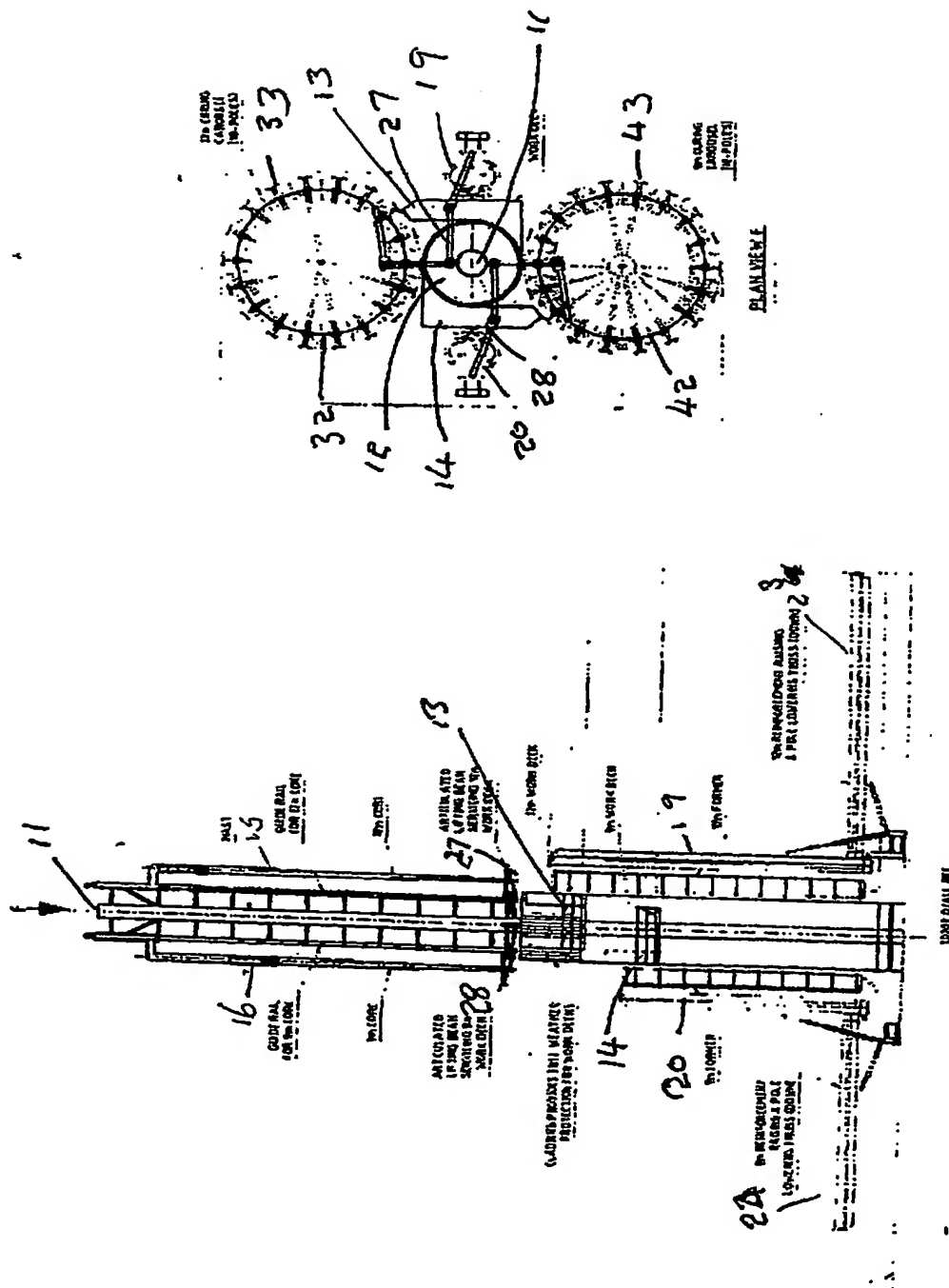
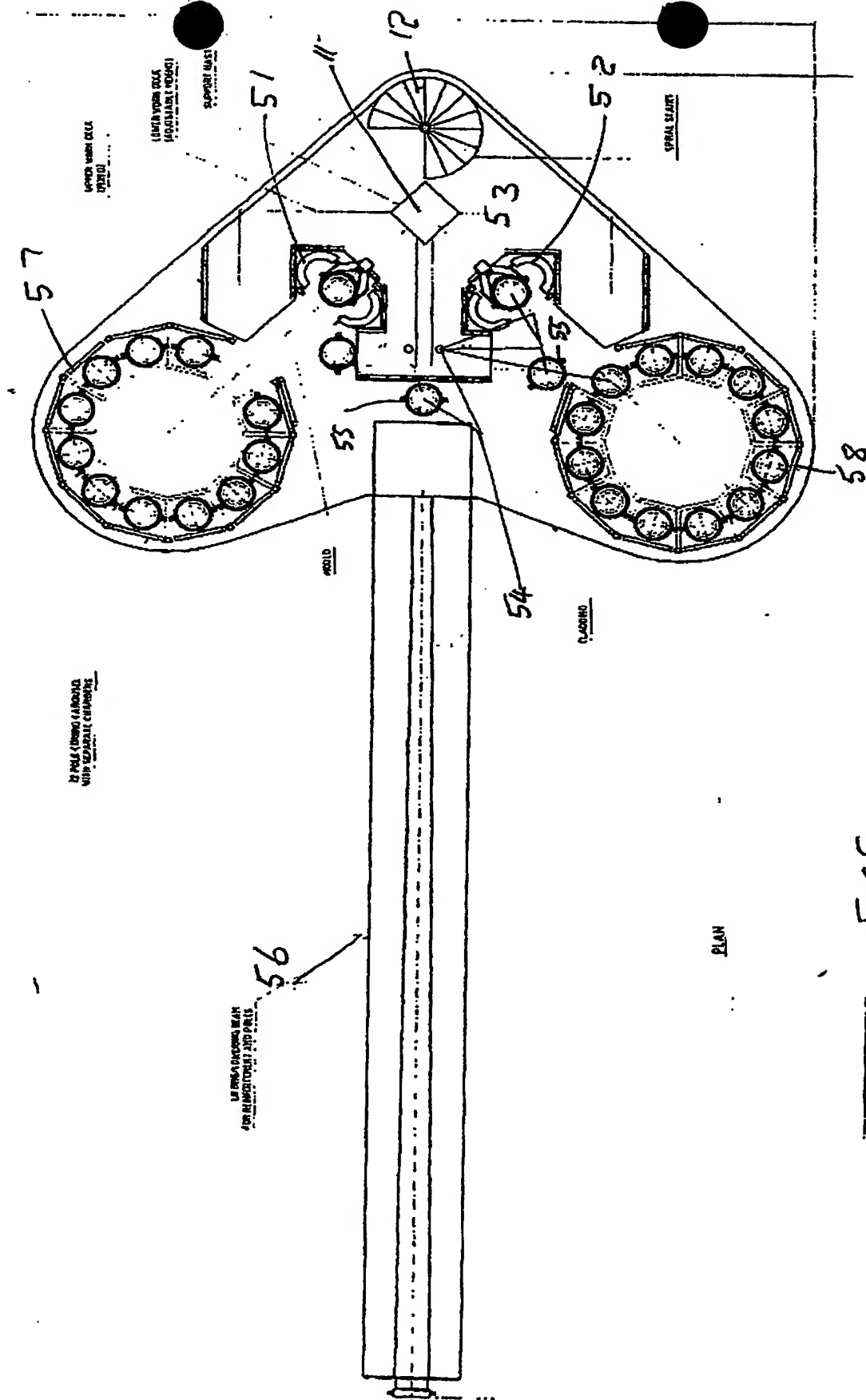


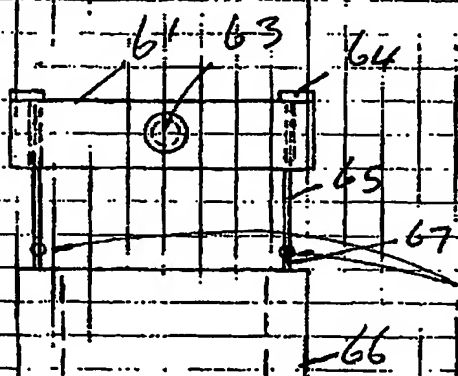
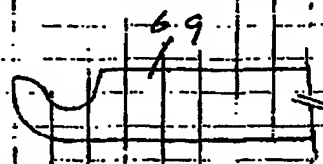
Fig 4

Fig 3



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FIGURE 8



Flexible joint (Can be one or several links)

FIG 6

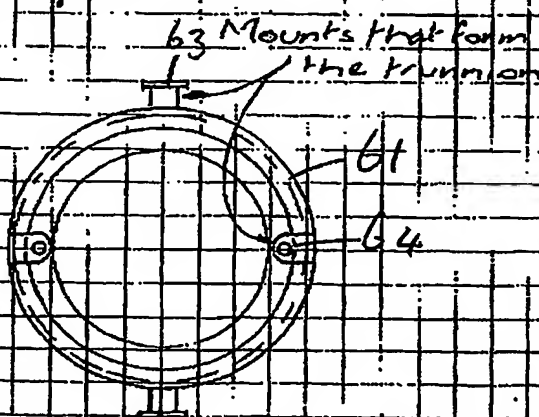


FIG 7